Mole Concept

C_{SD}-1 ⇒

(a) No. of mole $= \frac{\text{Wt.}}{\text{M.wt}} = \frac{\text{Given Number}}{6.022 \times 10^{23}}$

Note → applicable in all physical state (solid, liq gas)

(b) No. of mole $= \frac{PXV}{RXT} = \frac{\text{Vol. of gas at S.T.P. (Litre)}}{22.4}$

Note → only for gaseous state

C_{SD}-2 ⇒ Suppose → $A_xB_y \rightarrow xA^{-y} + yB^{-x}$

(a) No. of total atom = $(x+y)$ × No. of molecules of A_xB_y

(b) No. of A-atom = x × No. of molecules of A_xB_y

(c) No. of B-atom = y × No. of molecules of A_xB_y

(d) No. of electrons = $(\Sigma Z_i X_i)$ × No. of molecules of A_xB_y

where – Z_i = Atomic No. of A, B —. atom

X_i = No. of atoms of A, B -- in molecules A_xB_y

No. of electron = $(Z_A X_A + Z_B X_B)$ × No. of molecules of A_xB_y

= $(Z_A xy + Z_B xy)$ × No. of molecules of A_xB_y

(e) No. of protons $= (\Sigma Z_i X_i) \times$ No. of molecules of A_xB_y

$= (Z_A x + Z_B x y) \times$ No. of molecules of A_xB_y

f) No. of neutrons $= \left(\sum [A-Z)_{i'} \cdot X_{i'}\right) \times$ No. of molecules of A_xB_y

Where → A = Atomic Mass No. of atom A, B - - -

Z = Atomic Number of atom A, B - - -

$X_{i'}$ = No. of atoms (A, B - -) present in one molecule of A_xB_y

Example → C_3O_2

No. of neutrons $= [(12-6)\times 3 + (16-8)\times 2] \times$ No. of molecule of A_xB_y

CSD-3 Suppose → $A^{\pm n}$ → ions given

(a) No. of protons = $\left(\sum z_i x_i\right) \times$ No. of ions of $A^{\pm n}$

(b) No. of neutrons = $\left(\sum (A-Z)_i x_i\right) \times$ No. of ions of $A^{\pm n}$

(c) Charge of ions = $n \times$ No. of ions $\times 1.6 \times 10^{-19}$ Coulomb

(d) No. of electrons →
- Cation $- A^{+n} = \left[\sum z_i x_i - n\right] \times$ No. of ions A^{+n}
- Anion $\Rightarrow A^{-n}$

$= \left[\sum z_i x_i + n\right] \times$ No. of ions A^{-n}

Csd-4

1 mole gas contains (ideal gas) = 22.4 litre vol. at S.T.P.

1 mole molecules contains wt equal to = Mwt in gram

1 mole species contains number = 6.022×10^{23} Number of species.

CSD-5 (a) in case of liquid & solid = vol. is given

mass = density x volume of liq.

than calculate mole by $\frac{\text{mass}}{\text{M.wt}}$ formula.

(b) in case of gas = vol. is given

$$\text{mole } (n) = \frac{P \times V}{R \times T} = \frac{\text{Vol. of gas at S.T.P.}}{22.4}$$

C_{SD}-6 ⇒ Atomic mass Number (A) = p+n

(a) ✱ ~~on~~ wt. of one molecule = A in amu = Aamu

(b) wt. of 1 mole molecule = A in gram = Agram

(c) $1\,amu = \frac{1}{N_A}\,gram = \frac{1}{6.022\times10^{23}} = 1.66\times10^{-24}\,gram$

(d) Average Atomic wt. (Avg.)

$$= \frac{\sum A_i X_i}{\sum X_i} = \frac{A_1X_1 + A_2X_2 + \cdots}{X_1 + X_2 + \cdots}$$

where $A_1, A_2 \cdots$ = Atomic wt of isotopes

$X_1, X_2 \cdots$ = wt. percentage
= mole percentage
= mole of isotopes
= Number of isotopes

(e) Molecular wt = sum of Atomic wt of atom present in molecules

(f) wt. of one molecule. = M.wt in amu = M wt amu

(g) wt. of 1 mole molecule = M wt in gram = M wt gram

(h) Average Molecular wt → $(M.wt)_{Avg.}$ or Mwt of gas mixture

(a) $(M.wt)_{Avg.} = \frac{\Sigma M_i x_i}{\Sigma x_i} = \frac{M_1x_1 + M_2x_2 ----}{x_1 + x_2 ----}$

where M_1, M_2 --- = M.wt of gas-1 & gas-2

x_1, x_2 = mole % of gas-1 & gas-2

= mole of gas-1 & gas-2

(b) $(M.wt)_{Avg} = \frac{d \times R \times T}{P}$ (only for ideal gas)

where → d = density of gas mixture

P = total pressure of gas mixture

$(M.wt)_{Avg} = \frac{W \times R \times T}{P \times V}$

where = W = total mass of gas mixture

P = total pressure of gas mixture

V = total vol. of gas mixture

CCD-7 **Epirical and Molecular formula**

(a) **Empirical formula** = minimum molar ratio (simple) of atom in molecules

$$\text{Mole} = \frac{\text{wt}}{\text{M.wt}} \text{ or } \frac{\text{wt\%}}{\text{M.wt}}$$

(b) **Molecular formula** = actual simple molar ratio of atom in molecule.

(c) $(M.f.) = n \times (E.f.)$

$$n = \frac{\text{wt. of molecular formula}}{\text{wt. of Empirical formula}}$$

C_{SD}-8

(a) Mass percentage of solute $= \frac{w_1}{(w_1+w_2)} \times 100$

(b) Mass % of solvent $= \frac{w_2}{(w_1+w_2)} \times 100$

where → w_1 = mass of solute

w_2 = mass of solvent

(c) x % (w|w) of solution → meaning

Mass of solute = x gram

Mass of solution = 100 gram

Mass of solvent = (100 - x) gram

(d) x % (w|v) of solution = Meaning

Mass of solute = x gram

Mass volume of solution = 100 ml

Mass of solvent = $[(100)xd - x]$ gram

where → d = density of sol^n (g|ml)

(e) x % (v|v) of solution = Meaning

Volume of solute = x ml

volume of solution = 100 ml

volume of solvent = (100 - x) ml

CSD-9

(a) Mass % of solute ⇒ 100 gram solution me Kitna solute hai

(b) PPM ⇒ 10^6 gram solution me Kitna solute hai

(c) PPB ⇒ 10^9 gram solution me Kitna solute hai

$$P.P.M = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 10^6$$

$$PPB = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 10^9$$

(d) $P.P.M = 10^4 \times \text{Mass \%}$

(e) $PPB = 10^7 \times \text{Mass \%}$

(f) $PPB = 10^3 \times PPM$

CSD-10

(a) Mole fraction of solute (X_1) $= \frac{n_1}{(n_1+n_2)}$

(b) Mole fraction of solvent (X_2) $= \frac{n_2}{(n_1+n_2)}$

where → n_1 = mole of solute

n_2 = mole of solvent

(c) Mole % of solute = Mole fraction of solute $\times 100$

$= \frac{n_1}{(n_1+n_2)} \times 100$

(d) $\frac{X_1}{X_2} = \frac{n_1}{n_2}$

(e) $X_1 + X_2 = 1$

Note → Mole fraction of solute or solvent = given

Humbe ye pata hona chahiye

Mole fraction of solvent = also given

mole ratio of solute & solvent also given

CSD-II (a) Molality = $\frac{\text{No. of mole of solute}}{\text{Mass of solvent (gram)}} \times 10^3$

(b) $m = \frac{\text{No. of mole of solute}}{\text{Mass of sol}^n - \text{Mass of solute}} \times 10^3$

(c) $m = \frac{\text{No. of mole of solute}}{d \times v - \text{Mass of solute}} \times 10^3$

(d) $m = \frac{\text{No of mole of solute} \times 10^3}{}$

where → $d = \frac{g}{ml}$ } used ho

$v = ml$

(e) $m = \frac{M}{d \times 1000 - M \times \text{Mol. wt of solute}} \times 10^3$

Note → above formula used, only vol. of solution consider = 1L = 1000ml

C_{SD}-12

(a) Molarity of solution = $\frac{\text{Mole of solute}}{\text{Volume of solution (litre)}}$

(b) $M = \frac{\text{Mole of solute} \times \text{density of sol}^{n}\text{. (g/L)}}{\text{Mass of solution (gram)}}$

(c) Given that → (i) Mass % = x %.

(ii) density of sol^{n} = d g/L

than

$$\text{Molarity} = \frac{x \times \text{density of sol}^{n}\text{. (d)}}{(\text{M.wt})_{\text{solute}} \times \frac{\text{Mass}}{100}}$$

(d) No. of mole of solute = M x V (litre)

(e) Given that (i) x %. (w/v) of solution

than

$$\text{Molarity} = \frac{x \times 1000}{(\text{M.wt})_{\text{solute}} \times 100} = \frac{x \times 10}{(\text{M.wt})_{\text{solute}}}$$

CSD - 13

(a) Normality = $\frac{\text{No. of gram Equivalent of solute}}{\text{Volume of solution (Litre)}}$

(b) Normality = Molarity x n-factor

CSD-14 (a) Dilution = only Addition of solvent only

(b) (No. of mole of solute) before dilution = (No. of mole of solute) After dilution

(c)

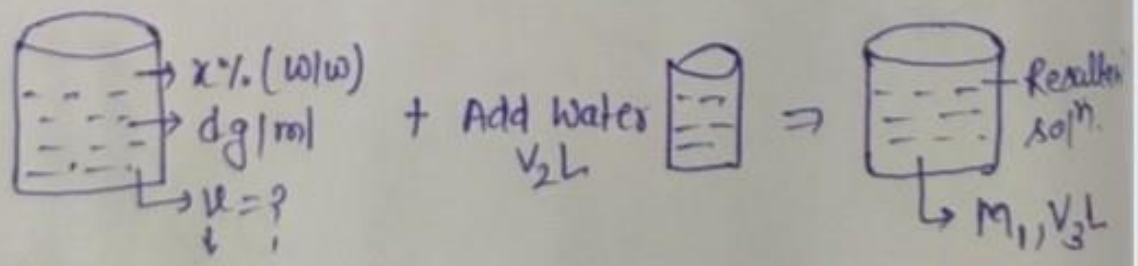
+ direct Add V_2 L of water = find Molarity of Resultant sol^n.

total volume of Resultant sol^n. $= (V_1 + V_2)$ L

(M) Molarity of Resultant sol^n. = ?

$(M_1 \times V_1)_{\text{mole of solute before dilution}} = [M \times (V_1 + V_2)]_{\text{mole of solute After dilution}}$

(d)



What volume required to form resultant sol^n. of M_1, V_3 L

(Mole of solute) before dilution = (Mole of solute) After dilution

$\left(\frac{x \times 10 \times d}{\text{M.wt} \times 1}\right)_{M} \times V$ Litre $= M_1 \times L_3$

(e) x%. (w/w) + Add water (V_2 L) ⇒ M_1, V_1

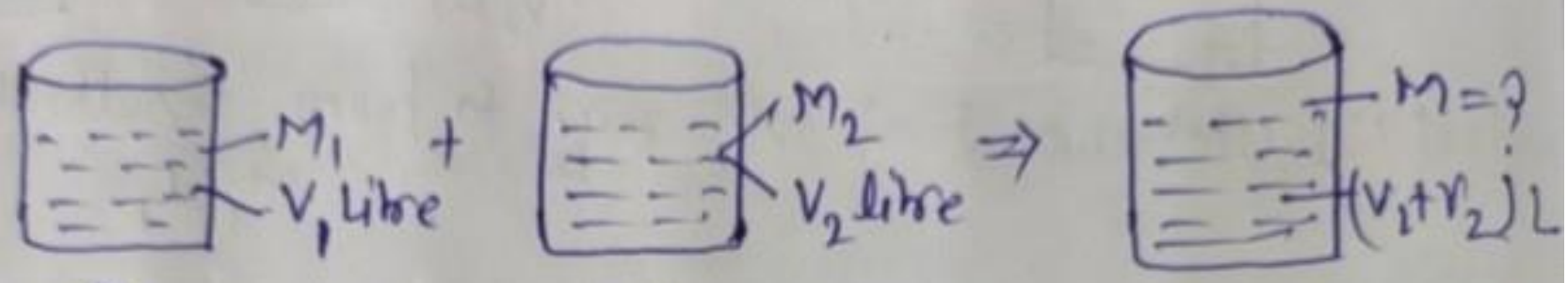
(W) What amount of soln. req. to form resultant soln. of M_1, V_1

(Mole of solute) before dilution = (Mole of solute) After dilution

$$\left(\frac{x \times w}{\text{M.wt of solute} \times 100}\right) = M_1 \times V_1$$

CSD.-15 Mixture of more than one Acid or Base

(a)



mole of solute = M_1V_1 M_2V_2 = $(M_1V_1 + M_2V_2)$ mol

Molarity of Resultant soln = $\frac{(M_1V_1 + M_2V_2)}{(V_1+V_2)}$

= $\frac{\text{total mole of solute}}{\text{total vol. of soln (Litre)}}$

C_{SD} - 16 Stoichiometric Calculation

(a) $n_1 A + n_2 B \longrightarrow n_3 AB$

Step-1. Reaction Balance Karo

Step-2 $\frac{(Mole)_A}{n_1} = \frac{(Mole)_B}{n_2} = \frac{(Mole)_{AB}}{n_3}$

(b) If sample or impure form of compound participate in chemical Reaction.

Mass of sample = w gram

Calculate % purity of sample or ~~% yield of compound~~

(*) % purity = % of a pure compound in an impure Compi.sample.

(**) $\%\ \text{purity} = \frac{\text{Mass of pure compound}}{\text{Mass of sample}} \times 100$

C_{SD}-17 **Percentage yields**

$$\% \text{ yield} = \frac{\text{Actual (Real) product form}}{\text{Expected theoritically product form}} \times 100$$

* Actual or Real or Experiment Value of product form → always given in Question

* Theoritically value of product ⇒ always calculated by students in stoichiometric method.

Question 1 mole of A and 1 mole of B react to each other and Experimently form 0.7 mole of AB. Calculate % yield of chemical Reaction.

$$A + B \longrightarrow AB$$

1	1	0	t=0
0	0	1	theoritical value

$$\% \text{ yield} = \frac{\text{Exp. value}}{\text{Theoritical value}} \times 100 = \frac{0.7}{1} \times 100 = 70\%$$

CSD-18 **Successive Reaction**

Jab 1st Reactⁿ ka product 2nd Reactⁿ me Reactant ka kam kare.

$$CaCO_3 \xrightarrow{\Delta} CaO + CO_2 \quad (1^{st}\ React^n)$$

$$\underline{CO_2} + H_2O + Na_2CO_3 \longrightarrow 2NaHCO_3 \quad (2^{nd}\ React^n)$$

$$\downarrow$$

$$?$$

CSD-19

Mixture react with Reagent

CASE-I Only one Reactant of mixture which participate in Reaction

$$\left(\frac{\text{Mole}}{\text{Coe.}}\right)_{\substack{\text{Reactant}\\ \text{participate}\\ \text{in Reaction}}} = \left(\frac{\text{Mole}}{\text{Coe.}}\right)_{\text{Reagent}}$$

(Note ⇒ Simple stoichiometric calculation wale question ki tarah hi kona hai)

Q. An alloy of Al and Cu was treated with aq. HCl soln.

$$2Al + 6HCl \longrightarrow 2AlCl_3 + 3H_2$$

but Cu remains as a pure metal. 0.2 gram sample of the alloy gave 0.224 Libre of H_2 gas at S.T.P. What is the wt. of Al in the alloy. ?

(a) 0.18 gram (b) 0.3 gram

(c) 0.6 gram (d) 0.86 gram

Csp-20 CASE-2 Both Reactant of mixture participate in chemical Reaction

Concept- → Jo diya jaye usi Ko nikal do

Q. An alloy of Al and Zn was treated with aq. HCl.

$2Al + 6HCl \longrightarrow 2AlCl_3 + 3H_2$

$Zn + 2HCl \longrightarrow ZnCl_2 + H_2$

A 0.2 gram sample of the alloy gave 0.230 litre of H_2 gas measured at S.T.P. what is the wt of Al in the alloy ?

(a) 0.18 gram (b) 0.3 gram

(c) 0.6 gram (d) 0.86 gram

Csp-21

Limiting Reagent

$$n_1 A + n_2 B \longrightarrow n_3 AB$$

Step-1 - Reaction = Balance honi chahiye

Step-2 → Minimum 2- Reactant Ki value given ek honi chahiye

Step-3 → $\left(\frac{\text{Mole}}{\text{ceo}}\right)$ Ratio jis Reactant ka small hoga, wahi L.R. hoga.

Step-4 ⇒ products always compare with L.R.

$$\left(\frac{\text{Mole}}{\text{ceo}}\right)_{\text{L.R}} = \left(\frac{\text{Mole}}{\text{ceo.}}\right)_{\text{final value}}$$